



Massachusetts  
Department  
of  
ENVIRONMENTAL  
PROTECTION

## fact sheet

# Perchlorate in Public Drinking Water

### What is Perchlorate?

The salts of perchloric acid ( $\text{HClO}_4$ ) are inorganic chemicals widely used as oxidizers in solid propellants for rockets, missiles, fireworks, and explosives. The most commonly used perchlorate salt is ammonium perchlorate ( $\text{NH}_4\text{ClO}_4$ ). Perchlorate ( $\text{ClO}_4^-$ ) may thus be found in surface and ground waters around military operations, defense contracting manufacturing facilities, and areas where blasting agents have been used or fireworks displays have been shown. Perchlorate may also be generated in small amounts associated with existing water treatment processes as part of the chlorination of water. Perchlorate has also been found at low concentrations in some groundwaters where no anthropogenic source is apparent. Perchlorate is highly mobile in water and can persist for many decades under typical ground and surface water conditions.

### How Might I be Exposed to Perchlorate?

Human exposure to perchlorate can occur if contaminated water is consumed directly, is used to make beverages such as tea, coffee or formula, or is used to cook foods that absorb a significant amount of water. Perchlorate has also been detected in several types of foods (e.g. some lettuces and milk, depending on where they are from), possibly from the use of perchlorate contaminated irrigation water, fertilizers, or feeds. Infants can be exposed to perchlorate through breast milk, depending on their mother's exposure. Absorption of perchlorate as a result of skin contact during showering and bathing is not a concern. However, children may be incidentally exposed by ingesting water while bathing. Showering only becomes a concern when perchlorate concentrations in water reach many hundreds of parts per billion, due to the inhalation of aerosolized particles in the air.

### What are the Health Effects of Perchlorate?

In sufficient concentrations, perchlorate disrupts normal function of the thyroid gland. It interferes with iodide uptake into the thyroid gland, decreasing the availability of iodide needed for the synthesis of thyroid hormones, which are essential for metabolism and normal growth and development. The impacts of disrupting thyroid hormone synthesis are greatest on pregnant women and their developing fetuses, infants, children, and individuals who have existing low levels of thyroid hormones, a condition called hypothyroidism.

Adverse health effects associated with perchlorate exposure are expected to be similar to those caused by iodine deficiency in humans. In areas of inadequate iodine intake, thyroid hormone synthesis and secretion decline, and the effects manifested in such iodine-deficient individuals, depending on the severity of the iodine deficiency, include: impairment in physical development, behavior, movement, speech, hearing, vision, and intelligence. Other effects of iodine deficiency also include signs and symptoms of hypothyroidism and enlargement of the thyroid gland. Impaired brain development and lower IQ were observed in children born to even mildly or moderately iodine deficient mothers.

## **When do the Perchlorate Regulations Become Effective?**

The regulation is effective upon publication in the Massachusetts Register (July 28, 2006). Monitoring for perchlorate at all Community and Non-Transient, Non-Community public water systems must begin January 1, 2007.

## **What is the Maximum Contaminant Level (MCL) for Perchlorate?**

The MCL for Perchlorate is 0.0020 milligrams per liter (mg/L) (2 parts per billion (ppb)). MassDEP will review and revise as necessary the perchlorate MCL within 6 years of its promulgation, taking into account new data on health effects, sources and occurrence, treatment techniques and associated issues, analytical feasibility, and any other relevant information.

## **What is the Initial Sampling Schedule for Perchlorate?**

Beginning in 2007 systems served by groundwater sources will need to monitor twice, once during the month of April and once during the month of September. Systems served by surface water will need to monitor for four consecutive quarters beginning in the first calendar quarter of 2007.

## **Are Grandfathered Data Allowed?**

If monitoring data collected after January 1, 2004 are generally consistent with the requirements of 310 CMR 22.06(9), the data may be used with the MassDEP's approval to satisfy the initial sampling requirements. However, regardless of the amount of historic sample results, all systems will be required to collect at least one sample round per year beginning with the 2007 calendar year.

## **What is the Long Term Monitoring Frequency for Perchlorate?**

The sampling frequency may be reduced to once per year after the initial monitoring period if all sample results indicate perchlorate concentrations less than 0.0010 mg/L.

## **What Happens if My Samples Exceed the Perchlorate MCL?**

- First, take a confirmation sample within 24 hours of the system's receipt of written notification of the sample results. Written notification is considered to include e-mail, fax, or letter.
- Report the initial sample result that exceeded the MCL to the applicable regional office of MassDEP within seven (7) days.
- Obtain written results of the confirmation sample from the laboratory within three (3) days of sampling.
- Report the confirmation sample results to MassDEP within three (3) days of the receipt of the written notification of the sample results.

## **What Results are Used for Compliance?**

The results of the initial and confirmation samples are both used and the results of both samples are arithmetically averaged. The resulting average is used to determine the system's compliance.

Massachusetts Department of  
Environmental Protection  
One Winter Street  
Boston, MA 02108-4746

Commonwealth of  
Massachusetts  
Mitt Romney, Governor

Executive Office of  
Environmental Affairs  
Robert W. Golledge, Jr.,  
Secretary

Department of  
Environmental Protection  
Arleen O'Donnell, Commissioner

Produced by the  
Bureau of Resource Protection,  
September 15, 2006.  
Printed on recycled paper.

This information is available in  
alternate format by calling our  
ADA Coordinator at  
(617) 574-6872.



## **What if the Results of My Sampling do not Exceed the MCL but are Greater than 0.0010 mg/L, MassDEP's Reporting Level?**

MassDEP has set a Perchlorate Trigger Level of 0.0010 mg/L. If the perchlorate concentration of any one sample is equal to or greater than 0.0010 mg/L, the repeat monitoring frequency for any public water system will then be on a quarterly basis for at least one year.

## **What Minimum Reporting Level (MRL) Must Be Used for the Analysis of Perchlorate?**

All compliance monitoring samples for perchlorate shall be collected using sterile sampling techniques. Sterile sample bottles, filters and instructions can be obtained from a MassDEP approved laboratory. The recent changes to the Drinking Water Regulations (310 CMR 22.00) introduce the term Minimum Reporting Level (MRL) for perchlorate analysis. MassDEP will only accept perchlorate results for which the laboratory reported MRL is no greater than 0.0010 mg/L. Analysis must be conducted using one of four approved methods for drinking water:

1. EPA method 314.0, revision 1.0, November 1999 as modified to achieve the MRL of 0.0010 mg/L (Ion Chromatography);
2. EPA Method 314.1 (Ion Chromatography);
3. EPA Method 331.0 (Liquid Chromatography Electrospray Ionization Mass Spectrometry (LC/MS or LC/MS/MS)); and,
4. EPA Method 332.0, (Ion Chromatography with Suppressed Conductivity and Electrospray Ionization Mass Spectrometry (IC/MS or IC/MS/MS)).

For a list of MassDEP approved labs go to:

<http://www.mass.gov/dep/water/drinking/wespub03.htm> and select the document under the heading "List of DEP-Approved Perchlorate Laboratories". MassDEP will be changing the laboratory certification regulations to formally certify for the analysis of perchlorate.

## **Can My System Apply to MassDEP for a Waiver from the Monitoring Frequencies for Perchlorate?**

Systems will not be eligible for Monitoring Waivers until the next compliance monitoring period (2008-2010). MassDEP will provide waiver applications for the 2008-2010 monitoring period in the fall of 2007. Waiver applications will have to meet the following conditions:

1. A system must take a minimum of one sample while the waiver is effective;
2. Surface water systems must have monitored annually for at least three years and groundwater systems must have conducted a minimum of three rounds of monitoring; and,
3. Systems must demonstrate that all previous analytical results were less than the MCL.

MassDEP shall approve or deny a waiver application based on land use issues, reported concentrations from all previous monitoring, the degree of variation in reported concentrations, and other factors that may affect perchlorate concentrations.

Massachusetts Department of  
Environmental Protection  
One Winter Street  
Boston, MA 02108-4746

Commonwealth of  
Massachusetts  
Mitt Romney, Governor

Executive Office of  
Environmental Affairs  
Robert W. Golledge, Jr.,  
Secretary

Department of  
Environmental Protection  
Arleen O'Donnell, Commissioner

Produced by the  
Bureau of Resource Protection,  
September 15, 2006.  
Printed on recycled paper.

This information is available in  
alternate format by calling our  
ADA Coordinator at  
(617) 574-6872.



## **What if My Perchlorate Results Exceed the MCL, is My System Required to Issue Public Notification?**

Exceedance of the perchlorate MCL, or a failure to take a confirmation sample within 24 hours of the system's receipt of written notification of the initial sample results, would require a Tier 1 public notification. Perchlorate is considered to have significant potential to have a serious effect on human health as a result of short-term exposure. The requirements for a Tier 1 public notification are found in MassDEP's Drinking Water Regulations, 310 CMR 22.16. Also the results must be included in the system's Consumer Confidence Report. Public notification must include the perchlorate health effects language found in 310 CMR 22.16.

## **What is the Best Available Technology (BAT) to Achieve Compliance with the MCL for Perchlorate if My System Needs to Treat to Meet Compliance?**

The BAT for perchlorate is Ion Exchange.

## **Where Can I Find Additional Information about Perchlorate on the Internet?**

Visit MassDEP's perchlorate page at:

<http://www.mass.gov/dep/water/drinking/percinfo.htm>

Visit EPA's perchlorate page at:

<http://www.epa.gov/safewater/ccl/perchlorate/perchlorate.html>

Visit the World Health Organizations home page at the following address and type "perchlorate" in the search engine provided near the top of the page.

<http://www.who.int/en/>

## **Who Should I Contact at MassDEP for More Information?**

Western Regional Office:

Mike McGrath

[Michael.McGrath@state.ma.us](mailto:Michael.McGrath@state.ma.us) - 413-755-2202

Central Regional Office:

Kelly Momberger

[Kelly.Momberger@state.ma.us](mailto:Kelly.Momberger@state.ma.us) - 508-849-4023

Northeast Regional Office:

Jim Persky

[James.Persky@state.ma.us](mailto:James.Persky@state.ma.us) - 978-694-3227

Southeast Regional Office:

Terry Martin

[Therese.Martin@state.ma.us](mailto:Therese.Martin@state.ma.us) - 508-946-2765

Massachusetts Department of  
Environmental Protection  
One Winter Street  
Boston, MA 02108-4746

Commonwealth of  
Massachusetts  
Mitt Romney, Governor

Executive Office of  
Environmental Affairs  
Robert W. Golledge, Jr.,  
Secretary

Department of  
Environmental Protection  
Arleen O'Donnell, Commissioner

Produced by the  
Bureau of Resource Protection,  
September 15, 2006.  
Printed on recycled paper.

This information is available in  
alternate format by calling our  
ADA Coordinator at  
(617) 574-6872.

